Finely Ground Dry Corn Supplementation to Improve Solids Not Fat Content of Crossbred Cattle Milk During Summer under Tropical Climate

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Abstract: Milk samples of Jersey and Holstein Friesian crossbred cattle (n=80) were analyzed from September 2005 to August 2006 for the fat and Solids Not Fat (SNF) contents. The fat percentage of the crossbred Jersey cow milk ranged from 3.00 to 6.30 per cent. The mean high (4.61± 0.08 per cent) fat content of Jersey crossbred cow milk was observed during the month of January 2006 and mean low fat (4.05 ± 0.08 per cent) content of milk was observed during the month of April 2006. The fat content of the Holstein Friesian crossbred cow milk ranged from 3.10 to 5.20 per cent. The high mean fat content (3.96 ± 0.10) was observed during the month of January 2006 and low mean (3.60 ± 0.07) fat content was noticed during the month of May 2006. The high mean SNF content (8.30± 0.04) for milk of Jersey crossbreds was observed during the month of December 2005 and low mean SNF content (7.97 ± 0.03) was observed during the month of May 2006. Similarly the high mean SNF content (8.19 ±0.02) was observed for the milk of Holstein Friesian crossbred during the month of December 2005 and low mean SNF content (7.91 ± 0.03) was observed during May 2006 with the values ranging between 7.70 to 8.70 per cent. A trial was conducted by incorporating Finely Ground Dry Corn (FGDC) in the diet of crossbred cattle to improve SNF content of milk. There was significant increase in milk yield with the supplementation of FGDC at the level of 10 (TJ2 and THF2), 20 (TJ3 and THF3) and 30 (TJ4 and THF4) per cent of the actual milk yield in Jersey and Holstein Friesian crossbreds. The increase in the milk yield was significant (P<0.01) between the control and the treatment groups of cows. There was no significant change in fat percentage between treatments in Jersey crossbreds. The SNF content was 8.13 ± 0.02 in the control (routine concentrate feed) milk and was 8.43 ± 0.01, 8.53 ± 0.02 and 8.56 ± 0.02 per cent in the milk samples of TJ2, TJ3 and TJ4 treatment groups respectively in Jersey milk. There was significant (P<0.01) difference in the fat percentage of milk between control and the treatment diet in Holstein Friesian milk. As the level of FGDC is increased in the diet there was significant (P<0.01) increase in the SNF content between THF 2 (8.37± 0.018), THF3 (8.42 ± 0.01) and THF4 (8.49 ± 0.01) compared to the control. It may be concluded that feeding of energy rich concentrates improves the SNF content of milk of crossbred cattle under tropical climate.

Key words: Cow milk, Fat and Solids not fat, Finely ground corn, Hot climate

INTRODUCTION

The minimum standards for market milks are fixed for fat and SNF contents to ensure quality milk supply to the consumers and to prevent adulteration of milk. Various grades of market milk are supplied to the consumer after standardization to the prescribed levels of fat and SNF content of milk. Indigenous cattle are being bred with exotic germplasm to increase the milk yield. As the exotic blood level increases there is an increase in the milk yield of the crossbred animals if the animals are in high plane of nutrition. In the underfed animals the milk yield and SNF in milk are low especially in Holstein Friesian Crosses and farmers suffer since low SNF milk is either not accepted or very low price is paid. The temperature prevailing in most part of the year is unfavorable for high milk production and SNF content. Hence, it becomes essential to take steps to improve the milk yield with required SNF content. Grinding of corn was found to decrease the fecal starch flow and to increase starch digestion[10]. Thus, particularly with the diets containing dry ground corn, post-ruminal digestion of starch was associated with digestion in the large intestine rather than in the small intestine.

Similarly, dry matter digestibility in the rumen and small intestine was not affected by grinding. Grinding of corn was found to increase the dry matter intake and to increase the milk production. Grinding process increased milk lactose yield and tended to increase milk protein yield and SNF yield[10]. Hence, a study was proposed to improve the SNF content of milk of crossbred cattle under tropical climate by increasing the energy content of the diet.
MATERIALS AND METHODS

A study on the fat and SNF content round the year for Jersey and Holstein Friesian crossbred cattle reared for milk production was necessary to ascertain the period of intervention and strategies to be followed to manipulate the composition of milk to cater the needs of the dairy industry. To study the fat and SNF trend in the milk of crossbred cattle 40 (morning and evening milk samples mixed) milk samples were collected from each of Jersey and Holstein Friesian crossbred animals weekly from the month of September 2005 to August 2006 under small holder village conditions of Namakkal District of Tamilnadu, India. Samples were collected by taking aseptic precautions and were stored at 5°C and analyzed on the same day. Based on the above study it was ascertained that the improvement in the SNF and fat content is required during the hottest months of the year (March to May). Hence, a study was designed to supplement the diet of the dairy cattle with energy rich feed ingredient like Finely Ground Dry Corn (FGDC) during the summer months since the crossbred cattle in the tropics will not get adequate energy during summer and more over the animals lose most of their energy for homeostasis. To study the effect of FGDC on the milk yield, fat and SNF contents of Jersey (n=28) and Holstein Friesian (n=28) crossbred cattle (approximately uniform in size and milk yield within the breed and 55-65 days of lactation) were selected. T1J group consisted of Jersey cross bred animals fed with routine concentrate mixture (containing 18 per cent DCP and 70 per cent TDN), T2J, T3J, T4J groups consisted of Jersey dairy animals fed with routine concentrate mixture supplemented with FGDC @ 10, 20 and 30 per cent of daily milk yield, respectively fed in two divided doses. Similarly, THF1 consisted of Holstein Friesian cross bred animals fed with routine concentrate mixture (containing 18 per cent DCP and 70 per cent TDN), THF2, THF3, THF 4 consisted of Holstein Friesian dairy animals fed with routine concentrate mixture supplemented with FGDC @ 10, 20 and 30 per cent of daily milk yield, respectively fed in two divided doses. All the animals were fed with green fodder (Bajra Napier Hybrid) @ 15 kg and paddy straw 5 kg per animal per day. Milk samples were collected from one week pre treatment and up to three weeks post treatment. The parameters like milk yield, fat and SNF were studied. The milk fat content was analyzed by Gerber’s method (ISI: 1224 - Part I 1977) and the SNF content of the milk was analyzed by gravimetric method by subtracting fat from the total solids. Total solids content was measured by a gravimetric procedure in which aliquots of whole milk were weighed before and after drying at 100°C. The data were statistically analyzed by ANOVA as described by Snedecor and Cochran using Microsoft Excel 2007 software.

RESULTS AND DISCUSSION

The environmental temperature during the period under study ranged from 32.8°C to 39.6 ºC and the relative humidity ranged from 50 to 70 per cent. Panting was observed in most of Holstein Friesian crossbred animals and in few Jersey crossbreds indicating their intolerance of the higher temperature. The reduced feed intake was observed during hottest hours of the day this was compensated by improvement in the intake during cooler hours.

Fat Percentage of Milk of Jersey and Holstein Friesian Crossbred Cattle: The fat and SNF content of the milk samples collected from September 2005 to August 2006 for Jersey and Holstein Friesian crossbreds are presented in the Fig. 1. The fat percentage of the crossbred Jersey cow milk ranged from 3.0 to 5.2 per cent. The mean high (4.61 ± 0.08) fat content of Jersey crossbred milk was noticed during the month of January 2006 and mean low fat (4.05 ± 0.08) content of milk was observed during the month of April 2006 when the mean atmospheric temperature was around 40°C. About 18.21 Per cent of the samples had less than the standard prescribed for cow milk i.e. 3.5 per cent fat.

The fat content of the Holstein Friesian crossbred cow milk ranged from 3.1 to 5.2 per cent. The high mean fat content (3.96 ± 0.10) was observed during the month of January 2006 and mean low (<3.0 ± 0.07) fat content could be noticed during the month of May 2006. About 26.27 per cent of the HF cross bred milk samples had less than 3.5 per cent fat.

SNF Content of Milk of Jersey and Holstein Friesian Crossbred Cattle: The SNF content of milk of the both the crossbred animals during the study period are presented in Fig. 2. The SNF percentage of Jersey crossbred cattle milk ranged from 7.80 to 8.80 per cent. The mean SNF per cent (8.30 ± 0.04 per cent) was observed to be high (8.30 ± 0.04 per cent) during the month of December 2005 and low mean SNF content (7.97 ± 0.03) was observed during the month of May 2006. Only 11.38 per cent of the milk samples had the SNF more than the standards prescribed for cow milk (8.5 per cent).

Similarly the high SNF content was observed for the Holstein Friesian crossbred milk during the month of December 2005 and low during May 2006 with the values ranging from 7.70 to 8.70 per cent. About 10.22 per cent of the HF crossbred milk samples had the SNF contents more than 8.5 per cent.

The results indicate that the fat and SNF contents of the milk of crossbred cattle need to be improved to the levels prescribed by the statutory bodies. The protein and SNF content of Jersey milk to be low during July and high during the winter season[12]. The highest values for fat, total solids, and SNF content of Jersey milk during the winter months

and the lowest values during the summer months\cite{5}. These differences were due mainly to the higher environmental temperature during summer months. Changes in the SNF content of milk was due to changes in the feeding practices that occurred concurrent with the change in season\cite{1}. Our study reveals that lower fat and SNF contents during the summer months of the year indicating that the fat and SNF are more vulnerable to the environmental temperature which indirectly reflect plane of nutrition. The results concur with the studies both in the United States\cite{14} and in Europe\cite{7} that the SNF content in June and July are rather consistently lower than in other months of the year.

Fig. 1: Mean milk fat percentage of Jersey and Holstein Friesian Crossbred cows from September 2005 to August 2006.

Manipulation of SNF Content of Milk by FGDC Supplementation in the Diet of Crossbred Cattle: Milk Yield, Fat and SNF Content of Jersey Crossbreds in Response to Supplemental FGDC Feeding During Summer Period: Milk yield, fat and SNF content of Jersey crossbred cows in response to supplemental FGDC feeding in summer are presented in Fig.3. The average milk yield was 9.78 ± 0.14, 9.95 ± 0.13, 10.62 ± 0.13 and 11.41 ± 0.13 litres for the control (TJ1), TJ2, TJ3 and TJ4, respectively. The increase in the milk yield was significant (P<0.01) between the control and the treatments. There was an increase in milk yield corresponding to increase in the level of FGDC in the diet of the Jersey crossbred cattle indicating that the animals were suffering from energy
malnutrition. Increase in milk yield may be attributed to increase in nutrient availability/digestibility in the total tract as indicated by\(^{(6)}\). Similar results were recorded when mid lactation animals were fed with high concentrate diet\(^{(10)}\). Blood glucose concentrations was found to be greater 4 h post-feeding, suggesting that the propionate supply and energy balance were greater for cows\(^{(6)}\). Increased ruminally degradable starch improves lactational performance probably because of higher production of VFA and greater ruminal bacterial yields\(^{(11)}\). Finely Ground Corn had higher efficiency of conversion of feed to milk\(^{(11)}\).

With reference to the fat percentage, there was an increase in the fat percentage from 4.68 ± 0.05 in the control group to 5.07 ± 0.06, 4.96 ± 0.06 and 5.05 ± 0.05 in TJ2, TJ3 and TJ4 respectively, but the increase was not significant between treatments. Increase in the fat percentage of milk may be attributed to better fibre digestion in the rumen and improved intake of roughages by the treatment group.

There was significant (P<0.01) increase in the SNF content of Jersey crossbred cattle milk to the treatment. The SNF content was 8.13 ± 0.02 in the control milk and was 8.43 ± 0.01, 8.53 ± 0.02 and 8.57 ± 0.02 in the three treatment levels respectively. As the grain level in the diet is increased there was corresponding increase in the SNF percentage of milk. Increase in the SNF content was statistically significant between treatments. The percentages of milk protein and SNF were significantly higher when the cows were fed rations with the higher energy\(^{(6)}\) Improved microbial protein yield might have improved the milk Protein precursors turn SNF content in the milk\(^{(11)}\).

**Milk Yield, Fat and SNF Content of Holstein Friesian Crossbred Milk in Response to supplemental FGDC Feeding in Summer:** Milk yield, fat and SNF Content of HF crossbreds in response to supplemental FGDC feeding in summer are presented in Fig. 4. There was a significant (P<0.01) increase in

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**Fig. 3:** Response of Jersey crossbred cows to FGDC Supplementation in the diet on Milk yield, fat percentage and SNF percentage.

**Fig. 4:** Response of Holstein Friesian crossbred cows to FGDC Supplementation in the diet on Milk yield, fat percentage and SNF percentage.
the milk yield of the HF crossbreds to increase in the FGDC content in their diet. The yield was significant (P<0.01) between THF2, THF3 and THF4.

Similarly there was a significant (P<0.01) difference in the fat percentage of milk between control and the treatment group. When the level of FGDC is increased in the diet there was a decrease in the fat percentage of milk in the THF4 treatment when compared to the THF2 and THF3. The decrease in the fat percentage was significant between THF3 and THF4. Similar observations were made by Drackley et al[6].

As the level of FGDC is increased in the diet there was significant (P<0.01) increase in the SNF per cent in the THF 2 (8.37± 0.02), THF3 (8.42 ± 0.01) and THF4 (8.49 ± 0.01) compared to the control. The SNF percentage was significant between the treatments also. Similar response of was observed for HF mid lactation cows to fed with high concentrate diet[6]. A large number of studies have indicated that the per cent SNF to increase when the plane of energy intake is elevated[3,4,6].

Conclusions: Based on the findings it may be concluded that

- High environmental temperature and the fodder shortage in hot climate are unfavourable for milk production.
- HF cross bred animals were worst hit by the temperature effect than the Jersey cross counterparts.
- Temperature and plane of nutrition affect the fat and SNF content of milk during most parts of the year under tropical regions.
- In summer the diet for the dairy animals should be supplemented with energy rich ingredients like FGDC to improve the SNF content since it is cheap and easily available for the dairy farmers.
- Energy enrichment with environmental management to reduce the temperature effect will increase the fat and SNF yield and performance of the animals.

REFERENCE